

Claims

- 1 1. A method of fabricating a polymer waveguide, comprising (a) forming a first polymer
2 film in proximity to a substrate, the first polymer film comprising a nonlinear optical
3 chromophore; (b) poling and crosslinking the first polymer film to provide a
4 crosslinked first electro-optic polymer film; (c) forming a second polymer film
5 comprising a nonlinear optical chromophore in proximity to the first electro-optic
6 polymer film; and (d) poling the second polymer film to provide a second electro-
7 optic polymer film.

- 1 2. The method of Claim 1, wherein the second electro-optic polymer film is crosslinked.

- 1 3. The method of Claim 1, wherein the refractive index of the second electro-optic
2 polymer film is lower than the refractive index of the first electro-optic polymer film.

- 1 4. The method of Claim 3, wherein the first electro-optic film is dry etched to form a rib
2 or quasi rib before the forming a second polymer film comprising a nonlinear optical
3 chromophore in proximity to the first electro-optic polymer film.

- 1 5. The method of Claim 4, wherein dry etching comprises using a metal hardmask.

- 1 6. The method of Claim 5, wherein the metal hardmask comprises titanium or platinum.

- 1 7. The method of Claim 4, wherein the rib or quasi rib is a Mach-Zehnder modulator,
2 directional coupler, or micro-ring resonator.

- 1 8. The method of Claim 4, wherein the substrate comprises a crosslinked electro-optic
2 polymer.

- 1 9. The method of Claim 4, further comprising (e) forming a polymer buffer clad in
2 proximity to the second electro-optic polymer film.

- 1 10. The method of Claim 9, wherein the first electro-optic polymer film has a thickness
2 of about 2.4 to about 3.8 μm and a refractive index of about 1.54 to about 1.62; the
3 second electro-optic first polymer film has a thickness of about 1.0 to about 3.0 μm

4 and a refractive index of about 1.53 to about 1.61; and the polymer buffer clad has a
5 thickness of about 2.2 to about 2.8 μm and a refractive index of about 1.445 to about
6 1.505.

- 1 11. The method of Claim 10, wherein the polymer buffer clad is crosslinked.
- 1 12. The method of Claim 3, wherein the first electro-optic polymer film is formed as a rib
2 quasi rib, quasi-trench, or trench by methods comprising laser ablation, bleaching,
3 positive tone photolithography, negative tone photolithography, or embossing.
- 1 13. The method of Claim 3, wherein the first electro-optic polymer film forms a trench or
2 quasi-trench.
- 1 14. The method of Claim 13, wherein the substrate comprises a crosslinked electro-optic
2 polymer.
- 1 15. The method of Claim 1, wherein crosslinking the first polymer film occurs above
2 about 160 °C.
- 1 16. The method of Claim 1, wherein the film is crosslinked during poling.
- 1 17. The method of Claim 1, wherein the film is crosslinked before poling.
- 1 18. The method of Claim 1, wherein the forming a first polymer film comprising a
2 nonlinear optical chromophore comprises spin coating, dip coating, or brushing.
- 1 19. The method of Claim 1, wherein the forming a second polymer film comprising a
2 nonlinear optical chromophore comprises spin coating, dip coating, or brushing.
- 1 20. The method of Claim 1, wherein the refractive index of the first electro-optic polymer
2 is lower than the refractive index of the second electro-optic polymer.
- 1 21. The method of Claim 20, further comprising (e) dry etching the second electro-optic
2 film to form a rib or quasi rib and (f) forming a polymer buffer clad in proximity to
3 the second electro-optic polymer film.

- 1 22. The method of Claim 21, wherein the polymer buffer clad is crosslinked.
- 1 23. The method of Claim 20, wherein the second electro-optic polymer film forms a
2 quasi-trench or trench.
- 1 24. The method of Claim 23, further comprising (e) forming a first polymer buffer clad in
2 proximity to the second electro-optic polymer film.
- 1 25. The method of Claim 24, wherein the polymer buffer clad is crosslinked.
- 1 26. The method of Claim 20, wherein the second electro-optic polymer film is formed as
2 a rib quasi rib, quasi-trench, or trench by methods comprising laser ablation,
3 bleaching, positive tone photolithography, negative tone photolithography, or
4 embossing.
- 1 27. The method of Claim 1, wherein the substrate comprises a polymer, an organically
2 modified sol-gel, or an electro-optic polymer.